

We claim:

1. A process for the recovery of anhydrous sodium carbonate from a hot aqueous solution containing sodium bicarbonate comprising:
  - a. decomposing the sodium bicarbonate portion of the hot aqueous solution to form a hot aqueous solution comprising sodium carbonate;
  - b. evaporating water from the hot aqueous solution comprising sodium carbonate to form a concentrated solution of sodium carbonate;
  - c. producing sodium carbonate monohydrate from the concentrated solution of sodium carbonate by crystallization; and
  - d. dewatering and calcining the sodium carbonate monohydrate to produce anhydrous sodium carbonate.

2. The process of Claim 1 wherein the hot aqueous solution containing sodium bicarbonate is essentially clear, is essentially free of solids and organics, and contains a minimal amount of salt.

3. The process of Claim 1 wherein the hot aqueous solution containing sodium bicarbonate is obtained from the solution mining of nahcolite with a hot aqueous liquid at a temperature of at least 250°F.

4. The process of Claim 1 wherein the hot aqueous solution containing sodium bicarbonate at a pressure sufficient to prevent the flashing of carbon dioxide.

5. The process of Claim 1 wherein the decomposition of the sodium bicarbonate in the hot aqueous solution occurs in one or more stages.

6. The process of Claim 1 wherein the decomposition of the sodium bicarbonate in the hot aqueous solution is carried out by steam stripping.

7. The process of Claim 6 wherein the decomposition of the sodium bicarbonate is carried out at the equilibrium steam temperature for the pressure of the decomposition.

8. The process of Claim 6 wherein the decomposition of the sodium bicarbonate is carried out by two stages of steam stripping.

9. The process of Claim 8 wherein the first stage of steam stripping is carried out at a higher pressure and temperature than the second stage.

10. The process of Claim 8 wherein the pressure of the first stage of steam stripping is 30 psig to 400 psig.

11. The process of Claim 8 wherein the pressure of the first stage of stream stripping is 50 psig to 110 psig.

12. The process of Claim 8 wherein the temperature of the first stage of steam stripping is 250°F. to 450°F.

13. The process of Claim 8 wherein the temperature of the first stage of steam stripping is 270°F. to 340°F.

14. The process of Claim 8 wherein the temperature of each stage of stripping is carried out at the equilibrium steam temperature at the pressure in that stage.

15. The process of Claim 8 wherein the vapor from the first stage of steam stripping is utilized to supply part of heat for the second stage of steam stripping.

16. The process of Claim 6 wherein the decomposition of the sodium bicarbonate is carried out with more than two stages of steam stripping with the temperature and pressure of each stage being such that the vapor from at least one prior stage can be utilized in the reboiler of a subsequent stage.

17. The process of Claim 6 wherein the decomposition of sodium bicarbonate is carried out with concurrent evaporation.

18. The process of Claim 5 wherein the decomposition of the sodium bicarbonate is accomplished in part by flashing prior to steam stripping.

19. The process of Claim 6 wherein the decomposition of the sodium bicarbonate is accomplished in part by flashing in an enlarged part of the first vessel utilized for steam stripping.

20. The process of Claim 18 wherein the pressure of the flashing is the same as the first stage of steam stripping.

21. The process of Claim 18 wherein the vapor from the flashing stage is combined with the vapor from the first stage of decomposition and is utilized to provide heat for a subsequent stage of decomposition.

22. The process of Claim 5 wherein the solution from the sodium bicarbonate decomposition contains 0% to 2.5% sodium bicarbonate.

23. The process of Claim 6 wherein the solution from the sodium bicarbonate decomposition contains 0% to 2.5% sodium bicarbonate.

24. The process of Claim 8 wherein the solution from the sodium bicarbonate decomposition contains 0% to 2.5% sodium bicarbonate.

25. The process of Claim 16 wherein the solution from the sodium bicarbonate decomposition contains 0% to 2.5% sodium bicarbonate.

26. The process of Claim 17 wherein the solution from the sodium bicarbonate decomposition contains 0% to 2.5% sodium bicarbonate.

27. The process of Claim 5 wherein the solution from the sodium bicarbonate decomposition contains 6.7% to 30% sodium carbonate.

28. The process of Claim 5 wherein the solution from the sodium bicarbonate decomposition contains from 12% to 27% sodium carbonate.

29. The process of Claim 5 wherein water is added during the sodium bicarbonate decomposition to maintain a solution below the sodium carbonate crystallization concentration.

30. The process of Claim 28 wherein the solution with sodium carbonate is fed to an evaporator.

31. The process of Claim 30 wherein the evaporator further concentrates the solution to between 25% to 30% sodium carbonate.

32. The process of Claim 30 wherein the vapor from the sodium bicarbonate decomposition is used, at least partially, to heat the evaporator.

33. The process of Claim 30 wherein the vapor from the evaporator is used, at least partially, as stripping steam in the sodium bicarbonate decomposition step.

34. The process of Claim 27 wherein the resulting concentrated solution from the evaporator is sent to the crystallizer and the crystallizer comprises a device selected from the group of multiple effect or MVR crystallizers.

35. The process of Claim 6 wherein at least a portion of the carbon dioxide in the vapor stream from the steam stripping is recovered as a byproduct.

36. A process for the recovery of anhydrous sodium carbonate and sodium bicarbonate from a hot aqueous solution containing sodium bicarbonate comprising:

- a. decomposing the sodium bicarbonate portion of the hot aqueous solution to form a hot aqueous solution of sodium carbonate;
- b. evaporating water from the hot aqueous solution comprising sodium carbonate to form a concentrated solution of sodium carbonate;
- c. producing sodium carbonate monohydrate from the concentrated solution of sodium carbonate by crystallization;
- d. dewatering and calcining the sodium carbonate monohydrate to produce anhydrous sodium carbonate;
- e. obtaining a purge stream containing sodium bicarbonate from at least one procedure selected from the group consisting of procedure a, procedure b and procedure c above;
- f. producing sodium bicarbonate from the purge stream by crystallization; and
- g. dewatering and drying the sodium bicarbonate.



37. The process of Claim 36 wherein the hot aqueous solution containing sodium bicarbonate is essentially clear, is essentially free of solids and organics and contains a minimal amount of salt.

38. The process of Claim 36 wherein the hot aqueous solution containing sodium bicarbonate is obtained from the solution mining of nahcolite with a hot aqueous liquid at a temperature of at least 250°F.

39. The process of Claim 36 wherein the hot aqueous solution containing sodium bicarbonate is at a pressure sufficient to prevent the flashing of carbon dioxide.

40. The process of Claim 36 wherein the decomposition of the sodium bicarbonate in the hot aqueous solution occurs in one or more stages.

41. The process of Claim 36 wherein the decomposition of the sodium bicarbonate in the hot aqueous solution is carried out by steam stripping.

42. The Process of Claim 41 wherein the decomposition of the sodium bicarbonate is carried out at the equilibrium steam temperature for the pressure of the decomposition.

43. The process of claim 41 wherein the decomposition of the sodium bicarbonate is carried out by two stages of steam stripping.

44. The process of Claim 43 wherein the first stage of steam stripping is carried out at a higher pressure and temperature than the second stage.

45. The process of Claim 43 wherein the pressure of the first stage of steam stripping is 30 psig to 400 psig.

46. The process of Claim 43 wherein the pressure of the first stage of stream stripping is 50 psig to 110 psig.

47. The process of Claim 43 wherein the temperature of the first stage of steam stripping is 250°F. to 450°F.

48. The process of Claim 43 wherein the temperature of the first stage of steam stripping is 270°F. to 340°F.

49. The process of Claim 43 wherein the temperature of each stage of stripping is carried out at the equilibrium steam temperature at the pressure in that stage.

50. The process of Claim 43 wherein the vapor from the first stage of steam stripping is utilized to supply part of heat for the second stage of steam stripping.

51. The process of Claim 41 wherein the decomposition of the sodium bicarbonate is carried out with more than two stages of steam stripping with the temperature and pressure of each stage being such that the vapor from at least one prior stage can be utilized in the reboiler of a subsequent stage.

52. The process of Claim 40 wherein the decomposition of sodium bicarbonate is carried out with concurrent evaporation.

53. The process of Claim 41 wherein the decomposition of the sodium bicarbonate is accomplished in part by flashing prior to steam stripping.

54. The process of Claim 41 wherein the decomposition of the sodium bicarbonate is accomplished in part by flashing in an enlarged part of the first vessel utilized for steam stripping.

55. The process of Claim 53 wherein the pressure of the flashing is the same as the first stage of steam stripping.

56. The process of Claim 53 wherein the vapor from the flashing stage is combined with the vapor from the first stage of decomposition and is utilized to provide heat for a subsequent stage of decomposition.

57. The process of Claim 40 wherein the solution from the sodium bicarbonate decomposition contains 0% to 2.5% sodium bicarbonate.

58. The process of Claim 41 wherein the solution from the sodium bicarbonate decomposition contains 0% to 2.5% sodium bicarbonate.

59. The process of Claim 43 wherein the solution from the sodium bicarbonate decomposition contains 0% to 2.5% sodium bicarbonate.

60. The process of Claim 51 wherein the solution from the sodium bicarbonate decomposition contains 0% to 2.5% sodium bicarbonate.

61. The process of Claim 52 wherein the solution from the sodium bicarbonate decomposition contains 0% to 2.5% sodium bicarbonate.

62. The process of Claim 40 wherein the solution from the sodium bicarbonate decomposition contains 6.7% to 30% sodium carbonate.

63. The process of Claim 40 wherein the solution from the sodium bicarbonate decomposition contains from 12% to 27% sodium carbonate.

64. The process of Claim 40 wherein water is added during the sodium bicarbonate decomposition to maintain a solution below the sodium carbonate crystallization concentration.

65. The process of Claim 63 wherein the solution with sodium carbonate is fed to an evaporator.

66. The process of Claim 65 wherein the evaporator further concentrates the solution to between 25% to 30% sodium carbonate.

67. The process of Claim 65 wherein the vapor from the sodium bicarbonate decomposition is used, at least partially, to heat the evaporator.

68. The process of Claim 65 wherein the vapor from the evaporator is used, at least partially, as stripping steam in the sodium bicarbonate decomposition step.

69. The process of Claim 65 wherein the resulting concentrated solution from the evaporator is sent to the crystallizer and the crystallizer comprises a device selected from the group of multiple effect or MVR crystallizers.

70. The process of Claim 68 wherein at least a portion of the purge from the sodium carbonate monohydrate crystallizer is fed to a sodium bicarbonate crystallizer.

71. The process of Claim 36 wherein the sodium bicarbonate crystallizer is a cooling crystallizer.

72. The process of Claim 71 wherein carbon dioxide is injected into the crystallizer concurrently with the sodium bicarbonate crystallization.

73. The process of Claim 70 wherein the liquid feed to the sodium bicarbonate crystallizer contains 0% to 4% sodium bicarbonate in solution.

74. The process of Claim 66 wherein at least a portion of the solution from the evaporator is fed to a sodium bicarbonate crystallizer.

75. The process of Claim 41 wherein at least part of the carbon dioxide in the vapor stream from the steam stripping is cooled to condense associated water, compressed, and introduced into the sodium bicarbonate crystallization.

76. The process of Claim 41 wherein at least a portion of the carbon dioxide in the vapor stream from the steam stripping is recovered as a byproduct.